WHAT IS CLAIMED IS:

1. A method of manufacturing a semiconductor structure, the method comprising:
providing a semiconductor substrate or substrate assembly;
providing a precursor composition comprising one or more zirconium complexes;
providing a precursor composition comprising one or more platinum complexes; and
forming a platinum-zirconium-containing film from the precursor compositions on a surface of the semiconductor substrate or substrate assembly.

2. The method of claim 1 wherein the step of forming a platinum-zirconium-containing film comprises vaporizing the precursor compositions and directing them toward the semiconductor substrate or substrate assembly using a chemical vapor deposition technique.

3. The method of claim 2 wherein the chemical vapor deposition technique comprises flash vaporization, bubbling, microdroplet formation, or combinations thereof.

4. The method of claim 1 wherein the semiconductor substrate is a silicon wafer or a gallium arsenide wafer or silicon on glass.

5. The method of claim 1 wherein the platinum precursor composition comprises a platinum complex selected from the group consisting of $CpPt(Me)_3$, wherein Me is a methyl group and Cp is substituted or unsubstituted cyclopentadienyl, $Pt(CO)_2Cl_2$, cis-$Pt(CH_3)_2[(CH_3)NC]_2$, $(COD)Pt(CH_3)_2$, $(COD)Pt(CH_3)Cl$, $(C_5H_5)Pt(CH_3)(CO)$,$(acac)(Pt)(CH_3)_3$, $Pt(acac)_2$, $Pt(PF_3)_4$, wherein COD = 1,5-cycloctadiene and acac =

acetylacetonate, and mixtures thereof.

6. The method of claim 1 wherein the zirconium precursor composition comprises a zirconium complex selected from the group consisting of $Zr(OC(CH_3)_3)_4$, $Zr(O(CH_2)_3CH_3)_4$, $Zr(O(CH_2)_2CH_3)_4$, $Zr(acac)_4$, and mixtures thereof.

√

7. A method of forming a film on a substrate, the method comprising:
providing a substrate;
providing a precursor composition comprising one or more zirconium complexes;
providing a precursor composition comprising one or more platinum complexes; and
vaporizing the precursor compositions and directing them toward the substrate to form a platinum-zirconium-containing film from the precursor compositions on a surface of the substrate.

8. The method of claim 7 wherein vaporizing the precursor compositions to form a platinum-zirconium-containing film comprises using a chemical vapor deposition technique.

9. The method of claim 7 wherein the platinum precursor composition comprises a platinum complex selected from the group consisting of $CpPt(Me)_3$, wherein Me is a methyl group and Cp is substituted or unsubstituted cyclopentadienyl, $Pt(CO)_2Cl_2$, cis-$Pt(CH_3)_2[(CH_3)NC]_2$, $(COD)Pt(CH_3)_2$, $(COD)Pt(CH_3)Cl$, $(C_5H_5)Pt(CH_3)(CO)$,$(acac)(Pt)(CH_3)_3$, $Pt(acac)_2$, $Pt(PF_3)_4$, wherein COD = 1,5 cycloctadiene and acac = acetylacetonate, and mixtures thereof.

10. The method of claim 1 wherein the zirconium precursor composition

comprises a zirconium complex selected from the group consisting of $Zr(OC(CH_3)_3)_4$, $Zr(O(CH_2)_3CH_3)_4$, $Zr(O(CH_2)_2CH_3)_4$, $Zr(acac)_4$, and mixtures thereof.

11. A capacitor comprising:
a first conductive layer;
a dielectric material on at least a portion of the first conductive layer; and
a second conductive layer on the dielectric material;
wherein at least one of the first and second layers comprises a platinum-zirconium film.

12. The capacitor of claim 11 wherein the platinum-zirconium film is vapor-deposited and includes platinum and zirconium in a ratio of platinum(x):zirconium(1-x), wherein x is in the range of about 0.3 to about 0.9.

13. The capacitor of claim 11 wherein the dielectric layer is selected from the group consisting of tantalum pentoxide (Ta_2O_5), Barium Strontium Titanate (BST), Strontium Titanate (ST), Lead Zirconium Titanate (PZT), Strontium Bismuth Tantalate (SBT) and Bismuth Zirconium Titanate (BZT).

14. The capacitor of claim 11 wherein the platinum precursor composition comprises a platinum complex selected from the group consisting of $CpPt(Me)_3$, wherein Me is a methyl group and Cp is substituted or unsubstituted cyclopentadienyl, $Pt(CO)_2Cl_2$, cis-$Pt(CH_3)_2[(CH_3)NC]_2$, $(COD)Pt(CH_3)_2$, $(COD)Pt(CH_3)Cl$, $(C_5H_5)Pt(CH_3)(CO)$,$(acac)(Pt)(CH_3)_3$, $Pt(acac)_2$, $Pt(PF_3)_4$, wherein COD = 1,5 cycloctadiene and acac = acetylacetonate, and mixtures thereof.

15. The capacitor of claim 11 wherein the zirconium precursor composition

comprises a zirconium complex selected from the group consisting of $Zr(OC(CH_3)_3)_4$, $Zr(O(CH_2)_3CH_3)_4$, $Zr(O(CH_2)_2CH_3)_4$, $Zr(acac)_4$, and mixtures thereof.

16. An integrated circuit comprising a capacitor, wherein the capacitor comprises:
a first conductive layer;
a dielectric material on at least a portion of the first conductive layer; and
a second conductive layer on the dielectric material;
wherein at least one of the first and second conductive layers comprises a platinum-zirconium film.

17. The integrated circuit of claim 16 wherein the platinum-zirconium film is vapor-deposited and includes platinum and zirconium in a ratio of platinum(x):zirconium(1-x), wherein x is in the range of about 0.3 to about 0.9.

18. The integrated circuit of claim 16 wherein the dielectric layer is selected from the group consisting of tantalum pentoxide (Ta_2O_5), Barium Strontium Titanate (BST), Strontium Titanate (ST), Lead Zirconium Titanate (PZT), Strontium Bismuth Tantalate (SBT) and Bismuth Zirconium Titanate (BZT).

19. The integrated circuit of claim 16 wherein the platinum precursor composition comprises a platinum complex selected from the group consisting of $CpPt(Me)_3$, wherein Me is a methyl group and Cp is substituted or unsubstituted cyclopentadienyl, $Pt(CO)_2Cl_2$, cis-$Pt(CH_3)_2[(CH_3)NC]_2$, $(COD)Pt(CH_3)_2$, $(COD)Pt(CH_3)Cl$, $(C_5H_5)Pt(CH_3)(CO)$,$(acac)(Pt)(CH_3)_3$, $Pt(acac)_2$, $Pt(PF_3)_4$, wherein COD = 1,5 cycloctadiene and acac = acetylacetonate, and mixtures thereof.

20. The integrated circuit of claim 16 wherein the zirconium precursor composition comprises a zirconium complex selected from the group consisting of $Zr(OC(CH_3)_3)_4$, $Zr(O(CH_2)_3CH_3)_4$, $Zr(O(CH_2)_2CH_3)_4$, $Zr(acac)_4$, and mixtures thereof.

21. A memory cell comprising a transistor and a capacitor comprising:
a first conductive layer;
a dielectric material on at least a portion of the first conductive layer; and
a second conductive layer on the dielectric material;
wherein at least one of the first and second layers comprises a platinum-zirconium film.

22. The memory cell of claim 21 wherein the platinum-zirconium film is vapor-deposited and includes platinum and zirconium in a ratio of platinum(x):zirconium(1-x), wherein x is in the range of about 0.3 to about 0.9.

23. The memory cell of claim 21 wherein the platinum precursor composition comprises a platinum complex selected from the group consisting of $CpPt(Me)_3$, wherein Me is a methyl group and Cp is substituted or unsubstituted cyclopentadienyl, $Pt(CO)_2Cl_2$, cis-$Pt(CH_3)_2[(CH_3)NC]_2$, $(COD)Pt(CH_3)_2$, $(COD)Pt(CH_3)Cl$, $(C_5H_5)Pt(CH_3)(CO)$,$(acac)(Pt)(CH_3)_3$, $Pt(acac)_2$, $Pt(PF_3)_4$, wherein COD = 1,5 cycloctadiene and acac = acetylacetonate, and mixtures thereof.

24. The memory cell of claim 21 wherein the zirconium precursor composition comprises a zirconium complex selected from the group consisting of $Zr(OC(CH_3)_3)_4$, $Zr(O(CH_2)_3CH_3)_4$, $Zr(O(CH_2)_2CH_3)_4$, $Zr(acac)_4$, and mixtures thereof.

25. A method for fabricating a capacitor comprising: 6

forming a first conductive layer;

forming a dielectric layer on at least a portion of the first conductive layer;

and

forming a second conductive layer on the dielectric layer;

wherein at least one of the first and second conductive layers comprises a platinum-zirconium film.

26. The method of claim 25 wherein the platinum-zirconium film is vapor-deposited and includes platinum and zirconium in a ratio of platinum(x):zirconium(1-x), wherein x is in the range of about 0.3 to about 0.9.

27. The method of claim 26 wherein the platinum-zirconium film is formed by chemical vapor co-deposition of platinum and zirconium precursor compositions.

28. The method of claim 27 wherein the platinum precursor composition comprises a platinum complex selected from the group consisting of $CpPt(Me)_3$, wherein Me is a methyl group and Cp is substituted or unsubstituted cyclopentadienyl, $Pt(CO)_2Cl_2$, cis-$Pt(CH_3)_2[(CH_3)NC]_2$, $(COD)Pt(CH_3)_2$, $(COD)Pt(CH_3)Cl$, $(C_5H_5)Pt(CH_3)(CO)$,$(acac)(Pt)(CH_3)_3$, $Pt(acac)_2$, $Pt(PF_3)_4$, wherein COD = 1,5 cycloctadiene and acac = acetylacetonate, and mixtures thereof.

29. The method of claim 28 wherein the platinum precursor composition comprises $CpPt(Me)_3$, wherein Me is a methyl group and Cp is methyl cyclopentadienyl.

30. The method of claim 27 wherein the zirconium precursor composition

comprises a zirconium complex selected from the group consisting of $Zr(OC(CH_3)_3)_4$, $Zr(O(CH_2)_3CH_3)_4$, $Zr(O(CH_2)_2CH_3)_4$, $Zr(acac)_4$, and mixtures thereof.

31. The method of claim 27 wherein the chemical vapor co-deposition is conducted by depositing a ratio of platinum to zirconium in the range of about 0.3 to about 0.9.

32. A method for fabricating a capacitor having a first and a second electrode, comprising:
providing a substrate;
forming an insulative layer overlying a substrate;
forming an opening in the insulative layer to expose the substrate;
forming a conductive plug in the opening, the conductive plug forming a first portion of the first electrode of the capacitor, the conductive plug recessed below a surface of the insulative layer;
forming a first conductive layer in the opening and overlying the conductive plug such that the first conductive layer is surrounded on sidewalls by the insulative layer, the first conductive layer forming a second portion of the first electrode, the first conductive layer being formed of a platinum-zirconium film; and
forming a second conductive layer overlying the first conductive layer, the second conductive layer forming a third portion of the first electrode.

33. The method of claim 32 further comprising:
creating a dielectric layer on the second conductive layer, the first conductive layer substantially preventing oxidation of the dielectric layer; and
creating the second electrode overlying the dielectric layer, the first and the

second electrode and the dielectric layer forming the capacitor.

34. The method of claim 33 wherein forming the second electrode comprises sputtering an electrically conductive material to overly the dielectric layer.

35. The method of claim 34 wherein forming the first conductive layer comprises:
admitting a platinum precursor composition to a chemical vapor deposition reaction chamber;
admitting a zirconium precursor composition to the chemical vapor deposition reaction chamber; and
applying sufficient reaction gas to the chemical vapor deposition reaction chamber to cause co-deposition of a platinum-zirconium film.

36. The method of claim 35 further comprising planarizing the insulative layer prior to forming the conductive plug.

37. The method of claim 36 wherein forming the conductive plug comprises depositing in-situ doped polysilicon in the opening.

38. A method of manufacturing a catalyst, the method comprising:
providing a substrate;
providing a precursor composition comprising one or more zirconium complexes;
providing a precursor composition comprising one or more platinum complexes; and
forming a platinum-zirconium-containing material from the precursor compositions on a surface of the substrate to form a catalyst.

39. The method of claim 38 wherein forming a platinum-zirconium-containing material occurs in the presence of an oxidizing gas.

40. A catalyst comprising a platinum-zirconium-containing material.

41. The catalyst of claim 40 wherein the platinum-zirconium-containing material comprises a roughened surface.

42. The catalyst of claim 41 wherein the roughened surface comprises a plurality of columnar pedestals.

43. The catalyst of claim 42 wherein the columnar pedestals are at least about 400 Angstroms tall.

44. A method of stabilizing a platinum film upon annealing the film at a temperature of at least about 650°C, the method comprising incorporating zirconium into the platinum film.

45. The method of claim 44 wherein the zirconium is at least partially oxidized.

46. The method of claim 44 wherein there are substantially no signs of island formation after annealing the platinum-zirconium film at a temperature of at least about 650°C.

47. The method of claim 44 wherein the zirconium incorporation does not substantially degrade the conductivity of the platinum film.